Unit 6 Study Guide Name AK S: ____

1) A vendor has 15 helium balloons for sale: 9 are yellow, 4 are red, and 2 are green. A balloon is selected at random and sold. If the first balloon sold is <u>known</u> to be yellow, what is the probability that the next balloon selected at random is yellow? Use proper notation and state your answer in decimal form rounded to the nearest thousandth.

$P(y|y) = \frac{8}{14}$ Started w/ 9 : 15

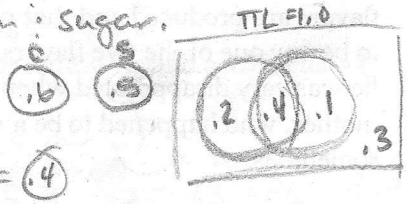
At Moe's diner, everyone drinks coffee. Let C = the event that a randomly-selected customer puts cream in his/her coffee. Let S = the event that a randomly-selected customer puts sugar in his/her coffee. Suppose that after years of collecting data, Moe has estimated the following probabilities:

$P(C) = 0.6$
$P(S) = 0.5$
$P(C \text{ or } S) = 0.7$

You can get coffee w/ both cream & sugar.

2) Find $P(C \text{ and } S)$ and interpret this value in the context of the problem.

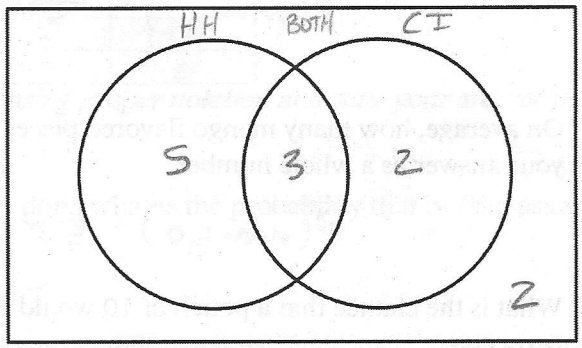
$P(C \text{ or } S) = P(C) + P(S) - P(C \cap S)$
$.7 = .6 + .5 - P(C \cap S)$ $P(C \cap S) = .6 + .5 - .7 = .4$



At a birthday party, hot dogs, hamburgers, birthday cake, and ice cream are going to be served. On the RSVP card, guests were asked to indicate which item(s) they preferred so enough food would be prepared for the party. The information has been organized in the table. Use the table to create a Venn diagram in the box below. Answer the questions based on the diagram.

Hot Dog &/or Hamburger	Cake &/or Ice Cream	Neither
GHA	GHA	
TAB		
HPE		
EMA	EMA	
		KRA
KPS		
	MER	
JRS		
	LAS	
JAG		
MOT	MOT	
		LTW

Both 3



TTL 12

3) What is the probability that a guest ate only cake &/or ice cream? Indicate this probability using proper notation and state your answer rounded to the nearest whole percent.

$P(CI) = 2/12 = 1/6 = .167$ 17%

4) What is the probability that of the guests who had a hot dog &/or a hamburger did not have cake &/or ice cream? Indicate this probability using proper notation and state your answer rounded to the nearest whole percent.

$P(\overline{CI} | HH) = 5/8 = .625$ 63%

5) What is the probability that one of the guests had a hot dog &/or hamburger and cake&/or ice cream? Indicate this probability using proper notation and state your answer as a decimal rounded to the nearest thousandth.

$P(HH \cap CI) = \frac{3}{12} = .25$ 25%

6) What is the probability that one of the guests had cake &/or ice cream but not a hot dog &/or hamburger? Indicate this probability using proper notation and state your answer as a decimal rounded to the nearest thousandth.

$P(CI \cap HH') = \frac{2}{12} = \frac{1}{6} = .167$ 17%

7) What is the probability that a guest had at least one item? State your answer as a decimal rounded to the nearest thousandth and as a percent rounded to the nearest tenth.

$P(\text{At Least 1 item}) = \frac{10}{12} = \frac{5}{6} = .83$

8) What is the probability that a guest had nothing to eat? Indicate this probability using proper notation and state your answer as a decimal rounded to the nearest thousandth.

$P(H \cup I)' = 2/12 = \frac{1}{6} = .167$

A seven-year-old boy has a favorite treat, Super Fruity Fruit Snax. These snacks come in pouches of 10 snack pieces per pouch, and the pouches are generally sold by the box, with each box containing 4 pouches. The snack pieces come in 5 different fruit flavors, and usually each pouch contains at least one piece from each of the 5 flavors. The website of the company that manufactures the product says that equal number of each of the 5 fruit flavors are produced and that pouches are filled in such a way that each piece added to the pouch is equally likely to be any one of the five flavors. Of all the 5 fruit flavors, the seven-year-old boy likes mango the best. One day, he was very disappointed when he opened a pouch and there were no mango flavored pieces in the pouch. His mother, who happened to be a statistician, assured him that this was no big deal and just happens by chance sometimes.

Box = 10 x 4 = 40 pcs 5 Fruit Flavors

Use proper notation to answer the following questions.

9) If the information on the company's website is correct, what percentage of the snack pieces is mango flavored?

$P(\text{mango}) = \frac{1}{5} = .20$

10) On average, how many mango flavored pieces should the boy expect in a pouch of 10 snack pieces? State your answer as a whole number

$P(\text{Mango}) = \frac{1}{5}$ or $\frac{2}{10}$ = two mango pcs.

11) What is the chance that a pouch of 10 would have no mango flavored pieces? State your answer as a percentage.

$P(\text{Mango}') = \left(\frac{4}{5}\right)^{10} = .107$

12) Was the boy's mother's statement reasonable? Explain.

If independent, the chance of getting 10 non-mango flavored pcs is about 11%, or a fairly reasonable statement,

13) The family later finds out that there were in fact no mango flavored pieces in any of the four pouches in the box they purchased. Again, if the information on the company's website is correct, what is the chance that an entire box of 4 pouches would have no mango flavored pieces?

$P(\text{mango}' \text{ 4 boxes}) = (.1074)^4 = .0001$

14) Based on your answer and based on the fact that this event of an entire box with no mango flavored snacks happened to this family, would you be concerned about the company's claims, or would you say that such an event is not surprising given the company's claims? Explain.

Yes, the company's claims do not match the family's experience.

Rain and Lightning. Answer each of the following questions using proper notation and justify your answer.

15) Today there is a 55% chance of rain, a 20% chance of lightning, and a 15% chance of lightning and rain together. Are the two events "rain today" and "lightning today" independent events?

$.55 \times .20 = .11 \neq .15$ Dependent

16) Now suppose that today there is a 60% chance of rain, a 15% chance of lightning, and a 20% chance of lightning if it's raining. What is the chance of both rain and lightning today?

$P(L|R) = \frac{P(L \cap R)}{P(R)}$ $.20 = \frac{P(L \cap R)}{.60}$ $P(L \cap R) = .20 \times .60 = .12$

17) Now suppose that today there is a 55% chance of rain, a 20% chance of lightning, and a 15% chance of lightning and rain. What is the chance that we will have rain or lightning today?

$P(L \text{ or } R) = P(L) + P(R) - P(L \text{ and } R)$
$= .20 + .55 - (.15) = .60$

18) Now suppose that today there is a 50% chance of rain, a 60% chance of rain or lightning, and a 15% chance of rain and lightning. What is the chance that we will have lightning today?

$P(R \text{ or } L) = P(R) + P(L) - P(R \text{ and } L)$
$.60 = .5 + P(L) - .15$; $.60 = .35 + PL$ $PL = .25$

All of the juniors and seniors, at a high school were classified according to grade level and response to the question "How do you usually get to school?" The resulting data are summarized in the two-way table below.

	Car	Bus	Walk	TTL
Juniors	96	455	89	640
Seniors	184	58	30	272
TTL	280	513	119	912

For each of the questions below, find the indicated probability using proper notation and state your answer in fraction form and rounded to the nearest thousandth.

19) If one of these students at this high school is selected at random, what is the probability that he/she usually takes a bus to school?

$513/912 \approx .563$

20) If one of these students says he or she is a junior, what is the probability that he/she usually walks to school?

$89/640 \approx .139$

21) If a student is one who arrives at school by car, what is the probability that he/she is a senior?

$184/280 \approx .657$

On April 15, 1912, the Titanic struck an iceberg and rapidly sank with only 710 of her 2,204 passengers and crew surviving. Data on survival of passengers are summarized in the table below.

	Survived	Did not Survive	Total
First class passengers	201	123	324
Second class passengers	118	166	284
Third class passengers	181	528	709
Total passengers	500	817	1317

22) Are the events "passenger survived" and "passenger was in first class" independent events? Support your answer using appropriate probability notation and calculations.

$P(A \cap B) = P(A) \cdot P(B)$
$P(S \cap FC) = P(S) \cdot P(FC)$

$\frac{201}{1317} \neq \frac{500}{1317} \cdot \frac{324}{1317}$ $\frac{2011}{1317} \neq \frac{162\,000}{1{,}734{,}489}$ Dependent

23) Are the events "passenger survived" and "passenger was in third class" independent events? Support your answer using appropriate probability notation and calculations.

$P(S \cap TC) = P(S) \cdot P(TC)$

$\frac{181}{1317} \neq \frac{500}{1317} \cdot \frac{709}{1317}$ $\quad \frac{181}{1317} \neq \frac{354,500}{1,734,489}$ Dependent

24) Did all the passengers aboard the Titanic have the same probability of surviving? Support your answer using appropriate probability notation and calculations.

$P(S) = \frac{500}{1317} = .38$; $P(FC\,S) = \frac{201}{1317} = .153$; $P(SCS) = \frac{118}{1317} = .09$; $P(TCS) = \frac{181}{1317} = .137$

There is not a huge diff amongst the classes.

Regarding the sinking of the Titanic, some believe that the rescue procedures favored the wealthier first class passengers. Others believe that the survival rates can be explained by the "women and children first" policy. Data on survival of passengers are summarized in the table below.

	Survived (S)	Did not survive	Total
Children in first class (CFC)	4	1	5
Women in first class (WFC)	139	4	143
Men in first class (MFC)	58	118	176
Children in second class (CSC)	22	0	22
Women in second class (WSC)	83	12	95
Men in second class (MSC)	13	154	167
Children in third class (CTC)	30	50	80
Women in third class (WTC)	91	88	179
Men in third class (MTC)	60	390	450
Total passengers	500	817	1317

Find the indicated probabilities using proper notation. State your answer in fraction form, as a decimal rounded to the nearest thousandth, and as a percent rounded to the nearest tenth. Also, interpret each result.

25) $P(S|FC) = \frac{201}{324} = .6203$ 62.0%

26) $P(S|SC) = \frac{118}{284} = .4154$ 41.5%

27) $P(S|TC) = \frac{181}{709} = .2552$ 25.5%

28) $P(\overline{FC} \cap S) = \frac{299}{1317} = .2270$ 22.7%

29) $P(C \cap S) = \frac{56}{1317} = .0425$ 4.3%

30) $P(\overline{M}|\overline{S}) = \frac{155}{817} = .1897$ 19.0%